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THE MIAMI CONSERVANCY BULLETIN

AUGUST 1920

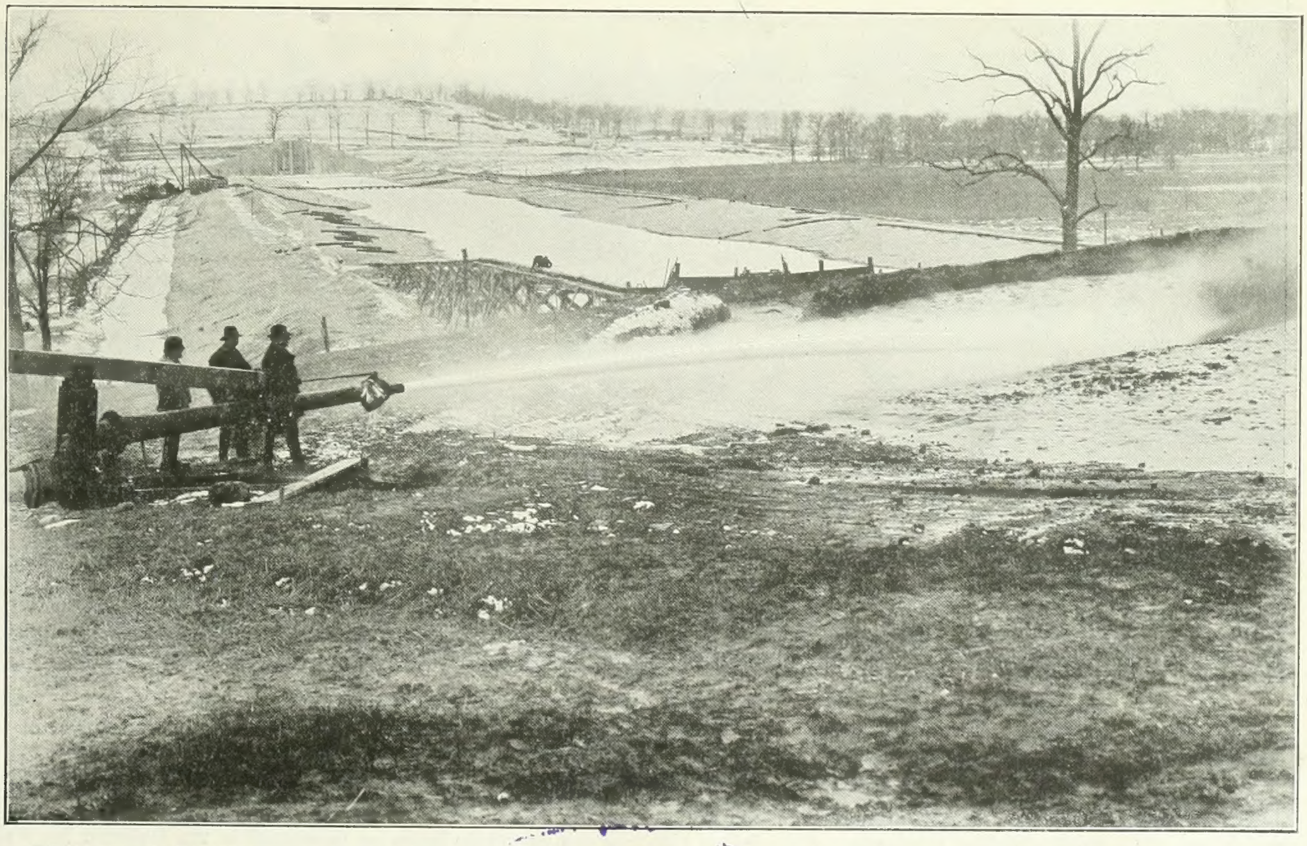

FIG. 168—LOOKING SOUTH ACROSS THE HUFFMAN BORROW PIT AND DAM. APRIL 18, 1920.

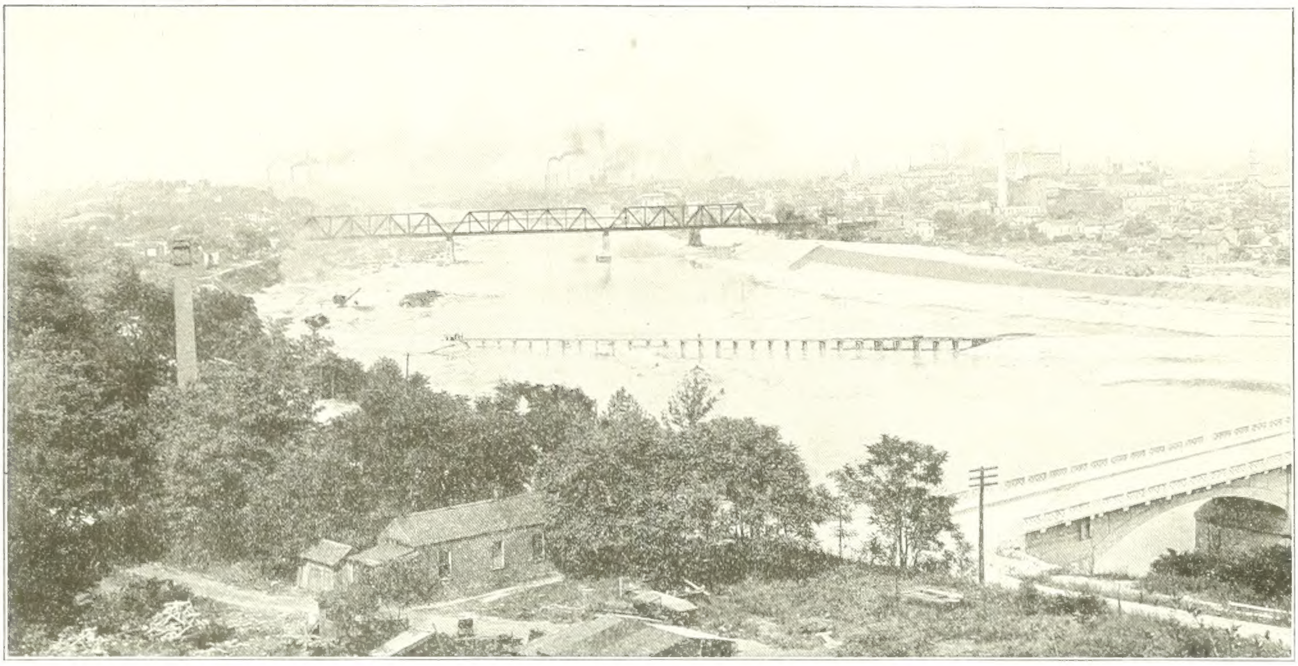

FIG. 169—LOOKING UP THE MIAMI RIVER AT HAMILTON. JUNE 10, 1920.

The view is from near the west end of the Columbia bridge, which is seen in the foreground at the right. Next upstream comes the trestle recently completed by Price Bros., which is now carrying the dump car trains across the river between the "dump" on the South Avenue spoil bank and the big dragline excavating the improved river channel on the west side just below High-Main street bridge, the trains being loaded with the material from the excavation. Across the river, opposite the trestle, the finished slope of the levee appears. This levee is now completed as far upstream as High-Main street bridge, (the second beyond the trestle). The dragline, which has just finished this work, together with the excavation of the east half of the channel, is just beginning to work down stream along the west bank, excavating the west half of the channel, and finishing up the west levee below the bridge.

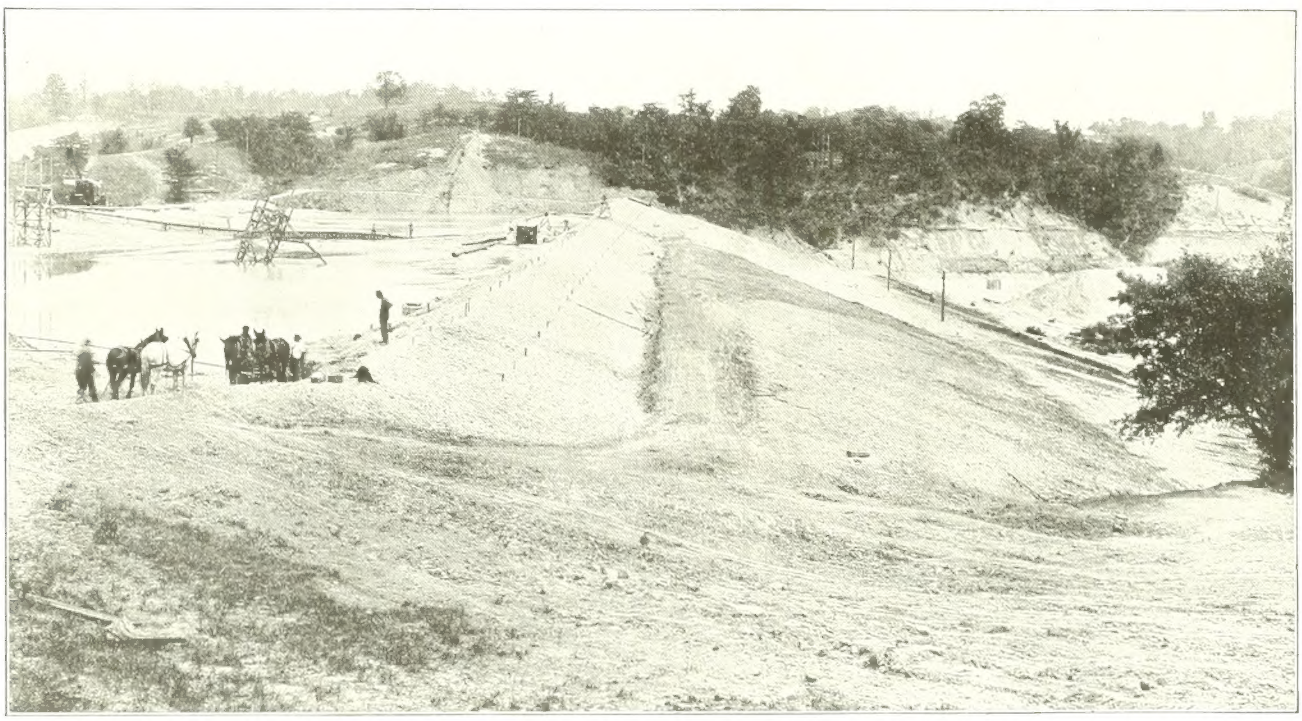

FIG. 170—LOOKING NORTHERLY ACROSS THE GERMANTOWN DAM. JUNE 7, 1920.

The slope seen is the downstream slope. The levee at its top is now at elevation 800, only 30 feet from the top of the dam. The top of the upstream slope is at elevation 795. The final elevation of the dam may be estimated as being at the top of the cut-off trench seen climbing the further hillslope between the two levees. Between the levees is the core pool. The small house at the top of the slope is a telephone box for the use of the pipe line gang in communicating with the pumpman. The bridge crossing the pool carries the pipe line for use in pumping for the downstream beach and levee. The small dragline excavator at the left is building the upstream levee as described in the Bulletin for February, 1920, using material brought by the dredge pipe line to the upstream beach. The two towers are for the support of the pressure cells which record the earth pressure in the interior of the dam core, furnishing an estimate of its stability.

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THE MIAMI CONSERVANCY BULLETIN

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Index

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G. L. Teeple, Assistant Engineer, Editor.

Lockington Dam Embankment Above 1913 Flood Level

Attention is called to the picture on page 15, showing the present condition of the work at Lockington. The entire embankment seen in the foreground, the east section, extending to the concrete outlet walls, has been deposited by hydraulic fill this season. Both east and west of the walls, the embankment is up to a level above that which would be reached, in the present open condition of the outlet structure, by a flood equal to that of 1913. Practically all danger of injury to the work from flood during construction is thus past.

It will be remembered that the borrow pit at Lockington is being excavated by hydraulic monitor, and sluiced down the hillslope to a sump, whence it is pumped to the dam. Careful study has been made of the special conditions at Lockington in this pit, and the efficiency of the work greatly promoted thereby. Thus the water in the sluice ditches is made to do its bit in the way of excavation, on its way down the slope, thus saving a considerable yardage which otherwise the monitor would have to do. Low pressure water, fed in at the head of the sluicing ditch, aids this action. At low levels in the pit, below possibility of sluicing directly, the material is excavated by dragline excavator, and dumped at a higher level whence in its loose condition it can be sluiced without a monitor to the sump. An article will be published in an early number of the Bulletin describing these expedients in detail.

The time lost in pumping at Lockington has been reduced to a very small fraction. During April, May and June, only 228 pump hours, or 7.8 per cent were lost out of a possible total of 2903. This includes the time lost from all causes, including high water and power interruption, except one week when all work was stopped to repair Plum Creek Aqueduct. During the last seven weeks the yardage pumped to the dam has averaged 3062 per day, or about 78,000 per month. The regular operating crew consists of 14 men on each of the two shifts. This includes four men each shift attending the discharge pipes on the dam embankment, but does not include the monitor movers.

Hydraulic Fill Cores

The recent paper of Mr. Allen Hazen, published in Vol. XLVI, No. 4, of the Proceedings of the American Society of Civil Engineers, calls attention once more to this subject. The upshot of his discussion is that all core materials finer than 0.0- millimeter should be wasted, and that the core, built of the coarser material remaining, should be made as narrow as possible. At San Pablo, the core pool was narrowed until it became "hardly more than a muddy creek remaining in the middle of the dam." Such a proposal, if adopted, would be a radical departure from practice which is the result of many years of successful dam building by this method. It would also involve a great increase in expense due to the finer core materials wasted. The one case of failure which can be brought against the hy-

draulic fill method when carried out under proper supervision, was due to a design involving the opposite extreme—an exceedingly wide core, of materials a large percentage of which were of extreme fineness. (Sixty per cent under 0.005 millimeter as against twenty per cent in the Conservancy dams). Considering carefully the record of hydraulic fill dam building, it was believed by the engineers of the District that a mean between the two extremes mentioned would represent safe, conservative, practice. A core width equal to the height of the dam above the core pool was therefore adopted, and is being carried out, with a grading of core materials which seldom requires waste. The actual solidification observed in the Conservancy cores bears out the practice adopted.

Gerard H. Matthes Goes to Tennessee River Investigation

The Bulletin announces with regret the resignation of Gerard H. Matthes from the engineering staff of the District, to take immediate charge of the preliminary surveys connected with the Tennessee River Investigation recently authorized by Congress, and now beginning under the auspices of the U. S. Army Engineering Corps. Mr. Matthes came to the District in 1915, as one of the staff of engineers engaged to carry out the preliminary studies necessary to the undertaking. He has thus been in Dayton five years. Of this period one year was spent in Hydraulic Studies; one in charge of the engineering end of the property appraisal; one as Office Engineer; and two in special work, in preparing for publication the early studies made by the District's engineering staff, and as an engineering expert testifying in the various law suits brought against the District, chiefly in matters of property appraisal.

The job to which he goes is perhaps more significant in certain features than any other now in progress. It is the first time that there has ever been undertaken in this country a complete and comprehensive survey of a river, involving all of its hydraulic resources—water supply, water power, flood protection and navigation. The entire possibilities of the Tennessee River, present and future, are to be studied, to the end that all of its resources may be correlated and conserved. Twenty-two damsites are now listed for investigation, representing water powers from 5,000 to 70,000 horse power, and totalling a million horse power. It is proposed to build the dams to elevations twenty feet or more above those which would be selected for power purposes alone, the excess storage, which on the upper levels of a reservoir are very great, being held in reserve for floor protection. This, which is not possible in the Miami Valley watershed, with its high percentage of valuable agricultural lands, its long season of low water flow, and its yearly rainfall of only 36 inches, is entirely feasible in the highlands of the upper Tennessee and its tributaries, where in the mountains the rainfall runs to 60 inches per year—nearly double the Miami Valley figure,—and is from 45 to 55 inches at lower elevations, and where the country is rough and wild.

Mr. Matthes has had twenty-one years' experience as a hydraulic engineer, divided almost equally between work in irrigation, water power and flood prevention, and is thus specially fitted for his new task. He will be Senior Assistant Engineer under Major Harold C. Fiske, Engineer Corps U. S. A., who has the entire work in charge. The Bulletin wishes and expects for Mr. Matthes' continued success in his new and important task. The editor is under unusual obligations to him for help many times extended and views his departure with especial regret.

E. W. Lane Goes to China

Mr. E. W. Lane, Assistant Engineer with the District, will leave San Francisco on the steamship "China," on August 21, bound for Shanghai, where he will make his headquarters for the present, as the representative of the Morgan Engineering Co., in matters pertaining to reclamation, water power and flood control. The immediate matter demanding his attention is the reclamation project at Nantungchow, which is in charge of Mr. Chang Chien.

Mr. Lane is a graduate of Purdue and of Cornell University, and has been with the Morgan Engineering Co. and the Miami Conservancy District since 1912, excepting for a period of 18 months when he was an officer in the U. S. Aviation Corps during the war. He has specialized in hydraulic engineering, conducting several investigations in that branch in a manner to mark him out as a man of unusual originality and force. He is thus specially fitted for the task which he now assumes. His many friends in the District will wish him every success in his new work. His job is an unusually responsible one, yet they regard it as but the beginning of his career.

Englewood Again Breaks Record

The record of material pumped into the dam at Englewood was again broken on July 15, when during a single shift of 10 hours, 611 cars were delivered on the embankment of the dam. This makes 4,888 cubic yards. The preceding record, made on May 28, was 4,600 cubic yards. Cross dam No. 2, enclosing the river section of the hydraulic fill, on the west bank, is up to elevation 814, or 60 per cent complete. The total yardage in the Englewood dam to date is 1,441,000, making the earth fill 41.2 per cent complete. Hydraulic fill is now being deposited in the river section.

Grouting Under Bridge Piers at Hamilton

The grouting of the gravel under the piers of the B. & O. stone arch bridge at Hamilton, referred to in the article on the Fordson tail race conduits in the last issue of the Bulletin, was carried out on July 15, 16 and 17. The grout was introduced through 2-inch gas pipe cast in the walls of the tail race conduits at 12-foot intervals and extending into the gravel,—16 pipes in all. A Ransome grouting machine was used, forcing this grout under pneumatic pressure through a hose connected with the gas pipes, under a pressure of 45 pounds. The grout was of one part cement and two parts water by volume. The gas pipes were first cleaned by inserting a smaller pipe. Pipe No. 2 took two sacks of cement, No. 9 took one sack and No. 15 took six sacks. None of the other pipes took more than enough to fill the pipe itself. No. 15, which took six sacks, had a small

(Continued on page 10.)

Sluicing Directly Into the Dam Core at Huffman

Material from Hillside Borrow Pit Containing Excess of Clay Corrects the Deficiency in Clay of Valley Bottom Pit. Hillside Material Deposited in Dam at Half the Cost of Dragline Excavation and Sluicing from Hog Box.

In the Bulletin for February, 1920, there was a dicussion of the hydraulic fill method of dam building, showing the relation of the core of the dam, which makes it water-tight, to the retaining embankments of sand and gravel which enclose the core on each side to hold it in place and give the dam stability. The ratio of the core thickness to the thickness of the retaining embankments, as there explained, is important. If the core is too narrow, there is danger that the core material, being thin mud when first deposited, and consolidating slowly, will be bridged across by protruding tongues of sand and gravel sliding in from the retaining embankments, thus reducing the imperviousness of the dam. If the core is too thick, there is danger (see the article referred to), of its bursting through the embankments, necessitating expensive work of reconstruction. Both these possibilities are avoided by properly proportioning the relative thickness of the core and retaining shoulders. In the Conservancy dams the rule adopted as a safe mean is to make the core thickness at any point in the dam equal to the distance from that point to the dam crest. This makes the core at the base not more than one-fifth of the dam thickness. With proper materials, such as are available for the Conservancy dams, and with this limit of core thickness, a hydraulic fill dam can be made as safe as any other type.

The "borrow pits," therefore, from which the materials are obtained to build the dams, ought to contain a ratio of fine materials, forming the core, to sand and gravel, forming the shoulders, to fit the above ratio. Otherwise an excess, either of fine or coarse, must be thrown away after being excavated, involving an addition to the expense of the work. If a borrow pit lacks either fine or coarse, the lack must if possible be supplied by opening another pit containing a proper proportion to correct the difficulty.

At the Conservancy dams, preliminary explorations were made, by means of borings and test pits, to determine the grading of the materials, and the best locations for the borrow pits to be opened. In most instances a favorable grading was obtainable. At Huffman, however, the preliminary explorations showed that on the valley bottom just above the damsite, the most economical location from other considerations, there might be a lack of "fines," and the grading of the material deposited in the dam, when this borrow pit was opened and construction was begun, bore out the probability. The gravel retaining embankments rose at a normal rate, but the core did not. The core pool, kept at normal width, deposited so little silt along its sides, which are formed by the sand and gravel retaining embankments, that it was unable to keep itself water-tight. The water seeped away through the embankments at the rate of about 6,000 gallons per minute, requiring almost the entire capacity of a 15″ dredge pump simply to counteract the leakage and keep the pool level at the proper point. This was of course a certain symptom, indicating the lack of sufficient fine

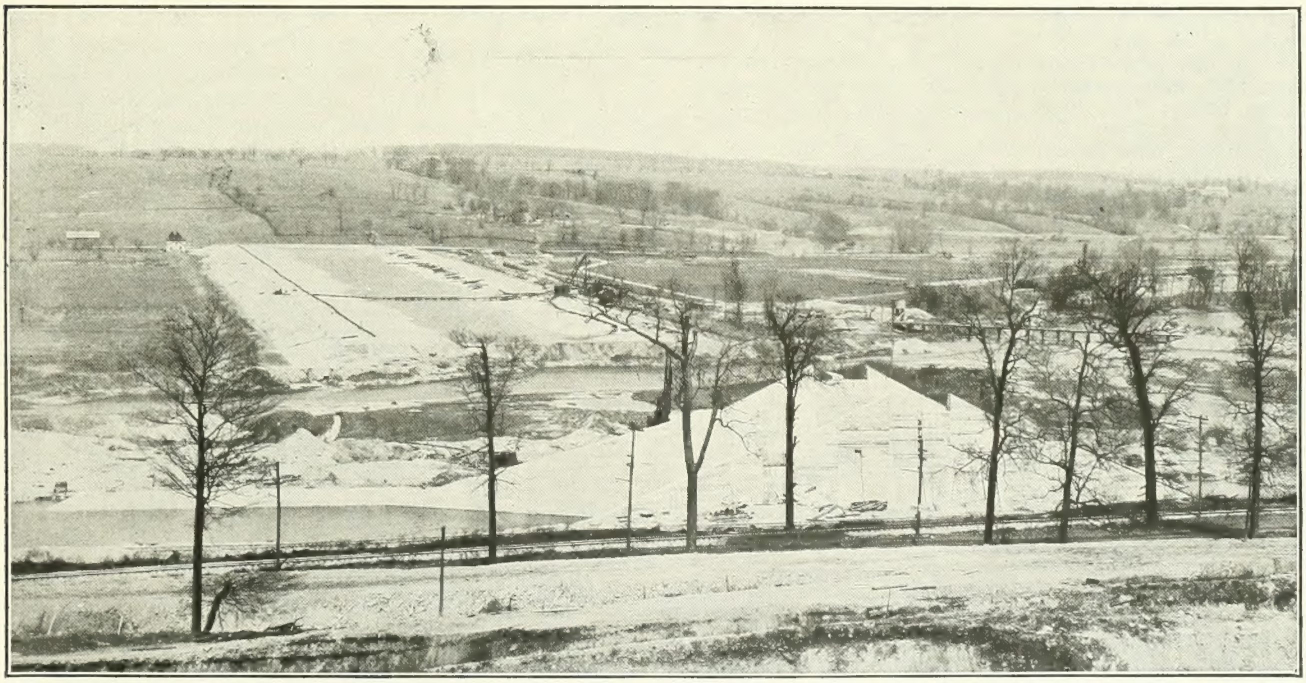

FIG. 171—LOOKING NORTH ACROSS HUFFMAN DAM FROM HUFFMAN HILL. MARCH 25, 1920.

The view is in the opposite direction from that of Fig. 168, and from the other side of the valley. The borrow pit in the foreground of that picture is on the hillslope across the dam in this. Mad River, seen flowing beyond the outlet structure walls, (in the foreground,) in a diversion channel dug for it, now flows between the walls; and the hydraulic fill is being deposited in the diversion channel. The valley bottom borrow pit shows as a narrow strip of white over the trees at the right, material for the dam being dug there and transported to the sump and pump house on the further edge of the dam embankment, which shows as a broad flat strip of white with a gray center, (the pool).

material in the borrow pit to build up a proper width of core.

Several methods of remedying the difficulty were proposed. One was to dig to a less depth in the borrow pit. The upper layer of the valley floor material, only a few feet thick, contains a much larger percentage of clay than the layers below. By adjusting the depth of digging, the material could be given the required proportions. But this shallower digging would require to be extended over a wider area to obtain the same amount of material, and this would require more construction track building, and would also increase the average distance the material must be hauled. Both items would increase the cost.

An alternative plan considered was to set a steam shovel to excavating in a clay bed along the edge of the valley, at the foot of the hills, and mix this clay in the hog box in proper proportions with the materials from the valley bottom pit. This would have required the purchase of additional large equipment, thus again increasing cost.

The third proposal was to "sluice" the additional fine material, necessary to a proper "mix," down from the hillside at one end or the other of the dam. At the south end the preliminary borings and test pits had showed but a few feet, and sometimes but a few inches, of the necessary fine clay and earth. At the north end, however, the tests showed a top layer of from two to eight feet of yellow clay, with some sand and gravel; and below this a layer of from four to twelve feet of hard blue clay; making from six to sixteen feet of the fine materials desired. The general scheme as proposed was to wash down this material with a powerful water jet, or "monitor," and run it down the hillside by gravity in a ditch or "ground sluice" into a cistern or "sump" at the foot of the slope, when it could be pumped by a dredge pump up to the dam embankment. The only additional equipment necessary in this case would be the monitor and a pair of high pressure centrifugal pumps, with the electric motors to drive them. Much of the material would be quite tough to tear down with a monitor, but even so, the cost would be probably less than the excavation of the material in the main borrow pit (by dragline excavator), and would certainly be no greater. The monitor pumps would be placed at the foot of the north hill and fed by a ditch connecting with Mad River.

Further study of the topography showed that it was possible to improve this scheme by carrying the mixed earth and water from the upper part of the hillside borrow pit directly to the top of the dam embankment by gravity by means of a "flume," thus saving the cost of pumping this portion of the material—about half the total available—from the sump at the valley bottom to the top of the dam. This modification was therefore adopted.

Such a method of carrying the "hydraulicked" material from the borrow pit to the dam top was in fact the original one used in the development of this process of dam construction in the early days of California placer mining. The flume was usually an open topped square box or trough of plank, laid on top of a trestle, the latter being built on a slope of from three to six feet in a hundred, and leading from

See Fig. 173 first, which is a cross section of the layout on the line "XX." "A" is the pipe flume line; "B", high pressure pump house; "C", high pressure pipe line; "D", entrance to pipe flume; "E", upper limit of borrow pit, May 1; "F", upper limit of borrow pit, June 1; "G", upper limit of borrow pit, July 1; "H", 3½ per cent grade line up the hill and limit of the borrow pit; "K", construction tracks; "M", supply ditch connecting with Mad River; "N", road; "S", sump; "T", first location of monitor; "U", second location of monitor.

Two ten-inch centrifu-

(Continued below)

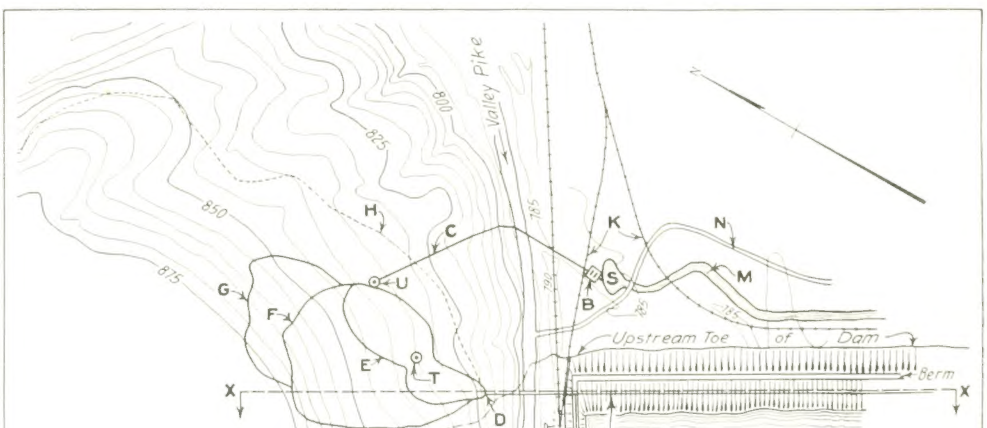

FIG. 172—HILLSIDE BORROW PIT LAYOUT AT HUFFMAN DAM

gal pumps at "B" take water from the sump "S" and pump it at about 310 pounds pressure through the pipe line "C" to the hydraulic monitor on the hillside at "U". The monitor jet washes the hillside material down about a 3½ per cent grade ditch in the borrow pit, ("E", "F", and "G" being the uphill limit of the pit at different dates,) to the mouth of the 15" pipe flume at "D". The flume crosses over the Erie tracks on a 3½ per cent grade trestle, (see Figs. 173 and 168.) Once across the tracks the trestle steepens its grade to 8 per cent in order to reach the level of the dam top with shorter length and thus save expense. From the end of the trestle the dredge pipe is carried along the dam top in the usual way, discharging its material on the beach of the core pool. (See Bulletin for February, 1920, pages 105-110.) The pipe flume branches so as to carry the material down both beaches of the pool, discharging alternately on each. The line "H", which climbs the hill from "D" on a 3½ per cent grade, marks the easterly limit at which it is possible to sluice the material to "D". Farther east, the borrow pit ditches would lie on flatter slopes and would fail to give the water the necessary velocity to carry the material.

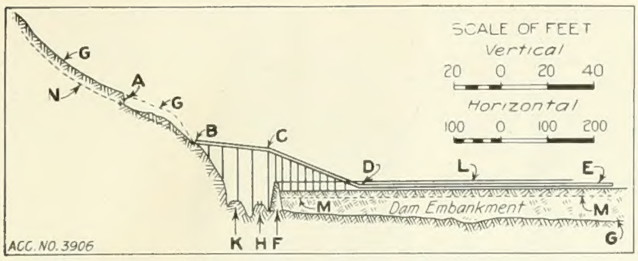

FIG. 173—PROFILE OF HILLSIDE BORROW PIT LAYOUT

Shows a section through dam and hillside along line "XX" in Fig. 172. "GG" marks the original ground surface; "AB" the limits of the borrow pit; "B" the entrance to the pipe flume; "BC" the 3½ per cent grade of trestle and flume; "CD" the 8 per cent grade of the same; "DE" the level length of dredge pipe line along the top of the dam embankment. "M" is the level of the water in the core pool; "F" the cross dam next the Erie track to retain the pool on the dam top; "H" the Erie railway; "K" the Valley Pike.

a ditch or "ground sluice" in the borrow pit, up on the hill side, to the top of the dam embankment in the valley below. (See also Fig. 168). The slope of the flume is kept as uniform as possible, and sufficiently steep to give the water a velocity which will roll the coarsest material (which might be stones weighing hundreds of pounds), down the flume to the dam embankment. The finer the material to be carried, the flatter can be the slope, slower water velocities being sufficient for these finer materials. Evidently also, the flatter the slope, the farther the material will be carried, with a given drop from the borrow pit to the dam. This last principle was applied at Huffman, as will be seen.

There being plenty of 15-inch steel dredge pipe on hand at Huffman, this was substituted for the wooden box flume, with several advantages. One is a less frictional resistance to flow than with a box flume of the same section. A more important one is that no trestle need be built to support it, since it can be laid following the inequalities of the ground, the head of water in the pipe on the hilltop driving the water through the level pipe below. At Huffman a short trestle was in fact built (see Fig. 172), but it was only to carry the pipe line over the Erie Railway line, high enough to clear traffic, the track running along the foot of the hill between the borrow pit and the dam embankment.

The pipe flume has the additional advantage at Huffman, as compared with an open box flume, in the flexibility with which it can be adapted to carry both coarse and fine materials to maximum distances. The Huffman hillside borrow pit contains considerable coarse material. To give the water sufficient velocity to carry this, the trestle across the Erie tracks has to be given a 3½ per cent grade, and the distance out on the dam to which the material can be carried is of course marked by the point where this 3½ per cent grade strikes the dam top. With an open box flume, this would be the limit to which any material could be carried, coarse or fine, without building a second flume. With the pipe flume, however, a thousand feet of pipe has been run out along the level dam top from the foot of the trestle, carrying the fine materials this additional distance, under the driving power given by the head of water in the pipe on the trestle slope. With coarse materials this head is all used up just to keep the material moving down the 3½ per cent grade, leaving no head available for further work.* The maximum gradient used with the finer materials has been as low as 1¾ per cent, these materials being about 80 per cent clay and the rest sand and gravel. The coarser materials contain about 75 per cent sand and gravel (up to stones about 12 inches in diameter), the remainder being clay. To carry the fine materials as far as they are carried by the pipe flume, a second box flume and trestle would have been required, built from end to end on a 1¾ per cent grade. Such a flume, if built, would not carry the coarse materials, but if fed with them would dam up and choke. On the other hand, the same pipe flume carries both coarse and fine, being extended length by length for the fine, down the length of the beach slope, just as in the usual operation for hydraulic fill. At Huffman, with fine materials occurring in one part of the borrow pit, and coarse in another, this flexibility of the pipe flume system has a great advantage.

Mention has been made of the tough blue clay of which much of the borrow pit is composed. It was known that this clay, inter-laminated with shale in places, would be hard to break down with a hy-

*The total head producing the flow is of course the vertical distance between the two ends of the pipe flume; and the "hydraulic gradient" is this head divided by the horizontal distance between the same two points.

The monitor has been elevated to exhibit the power of the stream. For excavating earth, its proper function, the jet is directed into the pit face at short range, from a foot to thirty or forty feet, so that the solid concentrated cylinder of water can develop its full boring power to break up the strata. (See Figs. 168 and 175.) The range of the jet in the picture is about 300 feet.

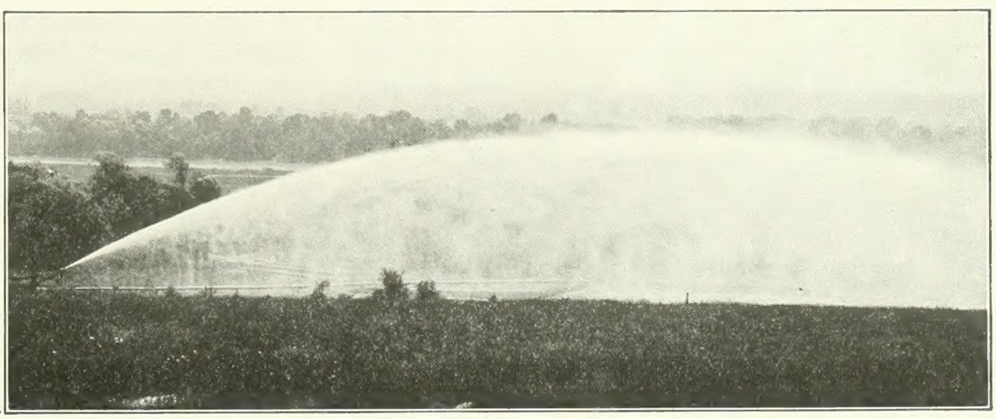

FIG. 174—THE HYDRAULIC MONITOR AT HUFFMAN, JUNE 14, 1920.

FIG. 175—THE MAN BEHIND THE GUN.

The picture shows Mr. George L. Albert, hydraulic engineer for the District in the special work of hydraulic fill, demonstrating the operation of the new hydraulic monitor in the hillside borrow pit at Huffman. (The regular operator, inadvertently beheaded by the photographer, is seen standing near.) Mr. Albert grew up with hydraulic fill in California, in the days when it was first applied to dam building, his father having been a mining engineer before him. He has remained "with the game" practically all his lifetime, and has accumulated a fund of experience which has been invaluable to the District in the hydraulic fill work at the dams.

draulic monitor, especially if the jet were small or if its velocity were low. It is usual to bring water to the borrow pit in considerable quantity at low head, to assist the water from the monitor in washing the material down the ground sluice after it is broken by the jet. At Huffman, to increase the power of the monitor, it was decided to make the size and velocity of the jet sufficient to yield all the water necessary to sluice the material after excavation. The design of monitor adopted was described in the Bulletin for April, page 136. (See also Fig. 168). Its length over all is 15 feet, and it can shoot a jet 5 inches in diameter with a "muzzle velocity" of about 140 feet per second, delivering 3,800 gallons of water per second, the pressure within the nozzle being about 135 pounds per square inch. The water is supplied by two ten-inch centrifugal pumps, each driven by a 200 horsepower motor. The two pumps are connected "in series," or "tandem," so that the outlet of one discharges directly into the suction pipe of the second. With this powerful equipment it has been possible, in spite of the hardness of the clay and shale strata, to break the material down without blasting. The location of the pumps at the foot of the hill slope, near the upstream toe of the dam, is shown in the plan in Fig. 172.

A notable feature of the sluicing layout described is the small force of men necessary to run it. One pumpman, one monitor man, one man at the pipe flume inlet to keep it clear, and two men at the discharge end on the dam, constitute the gang; five in all. At intervals, when it is necessary to move the giant to a new location, some additional help is required. Another feature is the simplicity of the layout, and the consequent freedom from liability to shutdown for repairs. The efficiency of the plant is proved by the records of runs day after day without such delays.

The new plant began operating about the first of May, and the results of the first three months' work have been very satisfactory. The seepage from the core pool has been stopped, as was proved when a 42-hour shutdown over the Fourth of July vacation lowered the pool level only about two inches, whereas before the installation of the new layout a thirteen hour shutdown would lower it 1.9 feet. The increased fine material sluiced into the core has built it up to its normal height, where it is being kept at proper elevation in relation to the sand and gravel beaches.

Another satisfactory result has been the reduction in cost. In spite of the toughness of the borrow pit material referred to, the cost of excavating and sluicing it to the dam has been only about 48 per cent of the cost of placing materials in the dam by the other methods in use. This result would alone have justified the cost of installing the layout, and if the hillside contained sufficient material it would pay to enlarge the equipment, and use it for building the entire dam. The lack of sufficient hillside material, however, compels the continued recourse to the valley bottom borrow pit as heretofore.

The capacity of the new layout is sufficient to sluice all the available hillside material into the dam before it is completed, using at the same time the valley bottom borrow pit material as originally planned.

The work at Huffman is in charge of C. C. Chambers, Division Engineer, J. S. Gena, Office Engineer, and Verne Clawson, Superintendent of Construction. The hydraulic fill work at all the dams is under the special superintendence of George L. Albert, Hydraulic Engineer for the District.

June Progress on the Work

GERMANTOWN

The pumping for the month of June brings the total embankment at the end of the month to 607,000 cubic yards, which is 77 per cent of the total. The upstream face of the dam has reached elevation 795 and the downstream slope is up to elevation 800, the dam crest being at 830.

The dragline has been excavating material continuously throughout the month, but has been forced to move ahead frequently on account of striking rock bottom, which lies a short distance below valley bottom.

The placing of the riprap, which is being laid up in mortar on the east bank of the inlet channel, and the facing of the dam with dry riprap, are both continuing daily and good headway is being made. Surface dressing is being placed on the downstream slope of the dam whenever weather permits and the teams are available.

The excavation on the spillway has been carried on continuously and at the present time about 5,000 cubic yards remain to be moved. A small concreting plant is now being erected for concreting the spillway and spillway bridge, and if cement can be secured it is the plan to start placing concrete not later than August 1.

The excavation for the part of Road No. 1, extending from the south end of the dam to the intersection with the state road, and also that part leading from the south end of the dam to camp, have been completed. The gravel surfacing will probably be placed during the coming months. A small gang is now building a guard rail fence on the portion of Road No. 1 on which the excavation has been completed.

Satisfactory progress is being made by J. C. McCann on Road No. 2, Feature No. 6. This work was started June 3 and is being rushed to completion as fast as possible.

Arthur L. Pauls, Division Engineer.

July 16, 1920.

ENGLEWOOD

The hydraulic fill has been continued in the river closure section during the month and at the present time the upstream and downstream levees are at elevation 812.5, that of the lowest berm of the dam. During the month of June 148,000 cubic yards of material were pumped. On July 1, 1,441,000 cubic yards of embankment had been placed. This makes 41.2 per cent of the dam completed. On July 15 the previous record of 510 cars of material pumped during one shift was broken. 611 cars were pumped during the day shift on that date.

Cross dam No. 2, on the west side of the old river bed, is at elevation 814 and is 60 per cent completed. The excavation for the temporary spillway has been finished and the concrete weir, located in the spillway at the downstream toe of the dam, is partially built. The object of this weir is to prevent wash of the soil at the spillway outlet when in use. Work has continued on the riprap and dry rubble paving at the inlet and outlet of the conduits.

H. W. Horner, Asst. Division Engineer.

July 16, 1920.

LOCKINGTON

Since July 8 the hydraulic filling has been going on over both the east and west parts of the dam, one pump unit depositing material continuously on each part. The edges of the fill have reached at all places an elevation of 916 feet, more than sufficient to care for a flood equal to that of 1913. There remains to be placed in the dam 303,000 cubic yards. During the last seven weeks the average run has been 3,062 cubic yards per day, which is equivalent to about 78,000 per month.

The stone surface dressing on the dam is being pushed in order that it may be finished at the same time as the fill. About twenty men are engaged on this work.

Arrangements are practically complete for resuming work on Road No. 9.

Barton M. Jones, Division Engineer.

July 20, 1920.

TAYLORSVILLE

The progress on the concrete outlet works to date this month is a little better than for the same date last monh. On Monday, July 19, a new record of 568 cubic yards for a single 10-hour shift was made. Unless there are some very serious and unexpected delays we will also make new records for a week and for a month. About 14,000 cubic yards remain to be poured yet, which indicates that we can easily finish by the latter part of October if we are not held up for cement.

The B. & O. R. R. has moved to its new location, the old roadway has been stripped and the cut-off trench dug through, and the hydraulic fill is once more progressing on the valley floor section, extending from the cross dike next the river to the hillside west of the old railway tracks. The materials are being excavated by hydraulic monitor on the east river bank near the north end of the inlet channel of the outlet works, in the new borrow pit. The materials from the excavation of the inlet channel, which work will be done by the Lidgerwood dragline, will be delivered to the monitor in this pit, and be sluiced to the sump along with the pit materials. The inlet excavation only awaits the cutting away of the adjacent hillside by the monitor so that this delivery can begin, which will be within a few days.

Mr. Crampton is making fair progress on Road No. 12.

O. N. Floyd, Division Engineer.

July 23, 1920.

HUFFMAN

The amount of ballast gravel delivered for the railroad work in the Huffman Basin has approached the total requirements, and it is expected that, about August 1, the pumping of material into the dam will be resumed by both the day and night shifts.

A rolled clay blanket is being placed under the upstream half of the dam where it crosses the diversion channel, which carried the flow of the river during the construction of the concrete outlet works.

The cut-off trench excavated under the dam, along its axis, has been completed from the end dam to the north concrete wall of the outlet structure, and the embankment in this section of the dam is now being made.

C. C. Chambers, Division Engineer.

July 19, 1920.

DAYTON

Dragline D-15 has completed the work of lowering the 10-in. gas main below Washington Street and is now progressing up stream with channel excavation. D-16 has completed the channel excavation above Third Street and is preparing to move under the bridge. D-19 is excavating a channel under Third Street bridge to permit the passage of D-16 on its scow. D-8 is feeding gravel to the charging derrick at the gravel screening plant.

South Robert Boulevard wall is 89 per cent completed, 3,960 cubic yards of concrete having been placed. Bank Street crest wall, on the right levee between Third and Fifth Streets, is under construction, being now about 25 per cent completed. Good progress is being made with the excavation for Stillwater Drive wall, about 11,000 cubic yards having been removed to date. The driving of steel sheet piling is now under way.

Concrete revetment is being placed just above Van Cleve park on the left bank of the Miami River.

To date 27,000 cubic yards of sand and gravel have been issued from the gravel plant.

Channel excavation to date amounts to 851,500 cubic yards. The pay quantity in spoil banks and levees amounts to 572,100 cubic yards. Levee embankment alone amounts to 75,500 cubic yards, including 60,000 cubic yards on Contract No. 41. The total yardage handled in accomplishing this work amounts to 1,497,600 cubic yards. None of the foregoing figures includes excess excavation for the launching basin and scowing canals, which amounts to 94,000 cubic yards.

C. A. Bock, Division Engineer.

July 19, 1920.

HAMILTON

Excavation and levee embankment on the east side of the river south of Main street have been completed by the electric dragline, D-16-18. This machine has moved across the river and is now loading cars on the west side, just south of the Main street bridge.

Dragline D-16-17 has completed excavation and pile driving on pier No. 3, Black street bridge, and is stacking up gravel to be used in concreting. The pouring of the mass concrete in the east abutment has been completed and forms are ready for the first run on pier No. 3. The piers are being built in open excavation, i. e., without the use of sheet piling. The bottom of pier No. 3 is 22 feet below water level in the river. No difficulty was experienced in unwatering this excavation. A cableway has been purchased for the bridge work and the erection of the towers is under way.

The Marion dragline D-16-20 has completed the construction track work on the west side of the river and is at present excavating a sewer trench for the relocation of the sanitary sewer in "A" street. This relocation is necessary because of the existing sewer being within the lines of the proposed channel.

Price Bros. have started driving piling for the revetment on the east side of the channel north of the railroad bridge. The total number of revetment blocks manufactured to date is 60,000.

Excavation is being continued on the Black & Clawson wall and concreting has been started on the south end of the wall.

The grouting under the piers of the stone arch bridge over Old River has been completed.

The total of Item 9, channel excavation, to July 1, was 704,000 cubic yards. The total of Item 34, levee embankment from channel excavation, was 160,400 cubic yards. During June 25,000 cubic yards were placed in the levee.

C. H. Eiffert, Division Engineer.

July 20, 1920.

TROY

Clapp, Worstrom & Riley have excavated 92,000 cubic yards, pay material, from the cut-off channel to date. Of this amount 30,700 cubic yards has been placed in levee embankment and the balance wasted, mostly along the left bank of the river. The cut-off channel has been completed for a length of 3,800 feet.

Since the first of July the dragline excavator has been cutting into the old river levee and casting the material about half way to the new levee location, the material so handled to be placed in final position in the new levee embankment on the second throw.

The contract for excavating the main river channel on the left or north side of the river, between the Baltimore & Ohio Railway bridge and the old timber dam above Adams Street, has been let to the C. & C. Haulage Co. The material from the excavation will be used in building a heavy embankment of width sufficient for roadway and shallow house lots, and ten to twelve feet in height, along the left side of the river between Market and Adams Streets. The remainder will be wasted in spoil banks on each side of North Market Street from the new levee as far north as Staunton Pike. These spoil banks will be raised to the street level and be made available for fine building lots.

The C. & C. Haulage Co. has already delivered a part of their equipment, consisting of a No. 18 Osgood steam shovel with a three-fourths cubic yard dipper, and three seven-ton Sterling trucks. This equipment is to be supplemented by a similar shovel and four more trucks by August 1. Excavation on this section of the work started July 13. The handling of material over soft ground by trucks is an innovation on this work.

R. F. Griffin, Assistant Engineer.

July 15, 1920.

LOWER RIVER WORK

Miamisburg—Since June 15 the material for the levee between the Groendyke spur track and the point where the levee strikes the high ground just south of the Germantown Pike has all been placed and about 40 per cent of the finishing completed. The highway extending southerly from the twine factory has been brought up to subgrade elevation, a fill of from eight to eleven feet, and will soon be graveled and opened to traffic.

Franklin—The levee from Miami Avenue westward to the gravel pit has been completed, but will not be dressed and seeded till fall. Twelve thousand cubic yards of this levee was placed during the past month. Trestle construction south of Lake Avenue is about 50 per cent complete. The contractor is now constructing the Lake Avenue approach, or road, extending over the levee. This will be completed in a few days and will be opened to traffic before Park Avenue is closed.

Middletown—Cole Brothers have placed 11,000 cubic yards in the levee between Fifth and Sixth Streets with the dragline and train outfit.

F. G. Blackwell, Assistant Engineer.

July 17, 1920.

RAILWAY RELOCATION

Big Four and Erie. The ballast on the Big Four has been all distributed with the exception of 4,000 feet at the west end, where the new line joins the old railroad. The latter will be raised to meet the new grade. The Big Four traffic will be diverted over the passing tracks while the track raising on this piece is being done. The new line in general on the Big Four will require about two weeks' dressing and surfacing. Arrangements are being made with the expectation of diverting traffic to the new line about the middle of August.

The progress on the Erie is keeping pace with that on the Big Four and will be completed shortly after the latter.

The signal systems at Tate's Point and Fairfield are very nearly completed. The Western Union telegraph line is also very nearly completed.

The District has a force of men doing odd jobs such as ditching, track signal work, pipe culverts, etc.

Baltimore & Ohio. The Baltimore & Ohio Railroad has been operating on the new line since July 7, 1920. The tearing up of the rails on the old line at Taylorsville was started on the 14th, making way for the Taylorsville dam. The rails on the old line were sold to the Baltimore & Ohio Railroad and they are beginning preparations for the removal of same. As soon as the old rails are removed at the Narrows the District will complete the widening out of the embankment with about 6,000 cubic yards of earth.

Ohio Electric. The first lift on the Ohio Electric ballasting is completed and the contractors are distributing material for the second lift. The overhead line wires on the trolley system are now being erected, the settting of poles being practically complete.

Albert Larsen, Division Engineer.

July 24, 1920.

RIVER AND WEATHER CONDITIONS

The river and weather conditions in the Miami Valley were comparatively normal during the month of June. The rivers were low during the entire month. The rainfall at the District's stations varied from 2.45 inches at Ingomar to 5.03 inches at Germantown, this wide variation being due to a succession of local thundershowers throughout the valley during the latter part of the month. At Dayton the rainfall amounted to 3.75 inches, or 0.21 inches less than normal.

Observations taken by the United States Weather Bureau at Dayton show that the mean temperature for the month was 70.3 degrees, or 1.7 degrees less than normal; that there were 13 clear days, 9 partly cloudy days, 8 cloudy days, and 13 days on which the precipitation amounted to or exceeded 0.01 of an inch; that the average wind velocity was 9.0 miles per hour, the prevailing direction being from the southwest; and that the maximum wind velocity for five minutes was 40 miles per hour from the northwest on the 2nd.

Ivan E. Houk, District Forecaster.

July 20, 1920.

Grouting Under Bridge Piers at Hamilton

(Continued from page 4.)

stream of water running out of it, indicating porous gravel. The grout forced this stream to find vent through pipe No. 14, till the latter was capped. The results as a whole, which were expected, are satisfactory as indicating a consolidated condition of the gravel under the piers.

Excavating Foundations by Dragline Excavator

Open Excavation, Without Sheet Piling, at Black Street Bridge, Hamilton, Effects Reduction in Cost.

An interesting variation of the usual methods used in excavating foundations for bridge piers is presented by the work on Pier No. 3 for the Black Street Bridge at Hamilton, construction of which, as announced in the last Bulletin, has been undertaken recently by the forces of the District. The finished excavation, with the piling driven, and the first section of the forms ready, is shown in Fig. 176. The pier is to be 28 by 62 feet in dimensions, of concrete, capping 150 piles spaced 3 feet apart each way. The usual plan for building such a pier is to drive a cofferdam of interlocking steel sheet piling around the pier site, bracing its walls against the external pressure, as the interior is excavated, by means of cross struts. The disadvantages of this method are the expense of the sheet steel piling, the cost of driving them, the necessity of using a clamshell, or similar bucket, of comparatively slow operation, in the actual work of excavation, and the interference of the cross bracing with both the digging and the final pile driving for the pier foundation.

Previous experience in excavating for the foundations of the wing walls which protect the abutments of the High-Main Street bridge in Hamilton, where a dragline had been substituted for a clamshell, had so demonstrated the superiority of the dragline in cases where the digging is tough or difficult, that the idea suggested itself to use the dragline for the excavation of the Black Street bridge piers. The nature of the proposed plan is clearly shown in Fig. 176. No sheet piling need be driven, the sides of the excavation being given the necessary slope to stand, (in this case about 2 to 1). There would be no cross bracing to get in the way of either the digging or the foundation pile driving. The excavation would be easy to get into or out of. ("You could drive a flivver into it," as one man expressed it). And the cost of excavation alone, in spite of the fact that about three to four times the quantity of earth must be moved, would be less than in excavating a sheet piling cofferdam with a clamshell.

The experiment was tried and proved highly successful. The excavator used was a Class 14 Bucyrus, with sixty foot boom, and 1½ yard bucket. The total depth of the excavation was about 26 feet, or which the upper 10 feet was porous river gravel, below which came 4 to 8 feet of clay, followed by cemented gravel the rest of the way. This lower stratum not being a hard gravel, yet with sufficient clay to be impervious, rendered the excavation easy. Thus the strata as a whole were excellently adapted to the desired end. The bottom of the excavation being 22 to 23 feet below water level in the river, the clay and cemented gravel rendered all but a six to seven foot thickness of the top layer tight, so that there was comparatively little seepage into the excavation; and this little was plugged to a large degree by seepage of silt into the porous layer, during a rise in the river which made the water muddy about the time the work of excavation was completed. The digging was done by the dragline bucket under water, pumping during

FIG. 176—OPEN EXCAVATION FOR PIER NO. 3, BLACK STREET BRIDGE, HAMILTON. JULY 21, 1920.
(See the descriptive article on this page.)

this period being therefore unnecessary. In a week after the digging was completed, the silting up of the porous gravel had cut the water seepage into the excavation by one half.

The Black Street bridge, it may be added, is to be a concrete structure, of seven arches, of 93 feet span each, center to center of the piers, with a 28 foot roadway and 6 foot sidewalks. The arches will be of the usual barrel type. The sidewalks and parapets will be partly cantilevered. The roadway will carry two street car tracks at the edges, with a driveway between wide enough to permit passing. At a later date, the roadway will probably be altered to a 40 foot width, and the tracks carried at the center as usual, the sidewalks being then entirely cantilevered to yield the extra width. Conduits are provided to carry gas, electric and water mains.

Three-Hinged Arch Road Bridge at Huffman

The reinforced concrete bridge, recently finished, carrying the relocated Springfield Pike across the new tracks of the Big Four and Erie Railways, just east of the Huffman Dam, is characterized by some distinguishing features. The pike runs approximately parallel with the new tracks both east and west of the crossing, and in order to reduce the curvature at the two approaches to a minimum, a pronounced skew was necessary, this being fixed at 40 degrees from the normal. The bridge had also to be built high and wide enough to afford clearance for four railway tracks, although only two will be constructed at this time. This meant a span of 125 or 130 feet. The materials of the rather heavy rock cut to be spanned are limestone and shale intermixed with thin layers of clay.

Under these conditions the type of bridge was determined only after much discussion. The bridge was being built by the Conservancy District for the two railways, and the latter, having the structure (excepting the roadway) to maintain after its completion, were interested in the design. The Big Four Railway proposed a steel girder construction incased in concrete, a reinforced concrete floor being provided to carry the highway traffic. This bridge was to be supported on heavy concrete piers and abutments. Such a design, while giving a very satisfactory and permanent bridge from many standpoints, was felt by the engineers of the District, on account of its great weight and the heavy thickness of concrete provided, to involve a somewhat greater expenditure than would be neecssary. They therefore proposed to make the structure a reinforced concrete arch, and to this the railroad company finally agreed.

The usual type of arch, whether in stone or concrete, is the so-called barrel type. It offers many advantages, and was first considered. With the heavy skew necessary, the construction of the concrete forms would be a comparatively simple problem. Moreover, the abutments in the side of the railway cut to be spanned appeared to be of sufficiently solid rock to form a satisfactory support for this type of structure.

The alternative design considered was the three-hinged arch, the advantages of which are chiefly in connection with its freedom from temperature stresses. A barrel arch is practically a monolith, with its ends, the abutments, maintained at a practically constant distance, summer or winter. The exposed parts, however, expand and contract appreciably, lifting and depressing the crown, and introducing bending stresses in the barrel which tend to crack its upper and lower surfaces. Such cracks in barrel arches may be not infrequently observed.

In the three-hinged arch this difficulty is avoided by making the structure jointed instead of solid. The arch is completely cut in two transversely at

FIG. 177—THREE-HINGED ARCH SKEW BRIDGE AT HUFFMAN. JUNE 26, 1920.

The opening in the center was necessary to provide passage for operation of a single track railway line. It was spanned by steel I-beams, as shown. The suspension cable of a slack line cableway can be seen above the timbering. This cableway was used to handle the false work bents, the spanning I-beams, and the stringers, as well as the concrete and the reinforcing steel for the concrete.

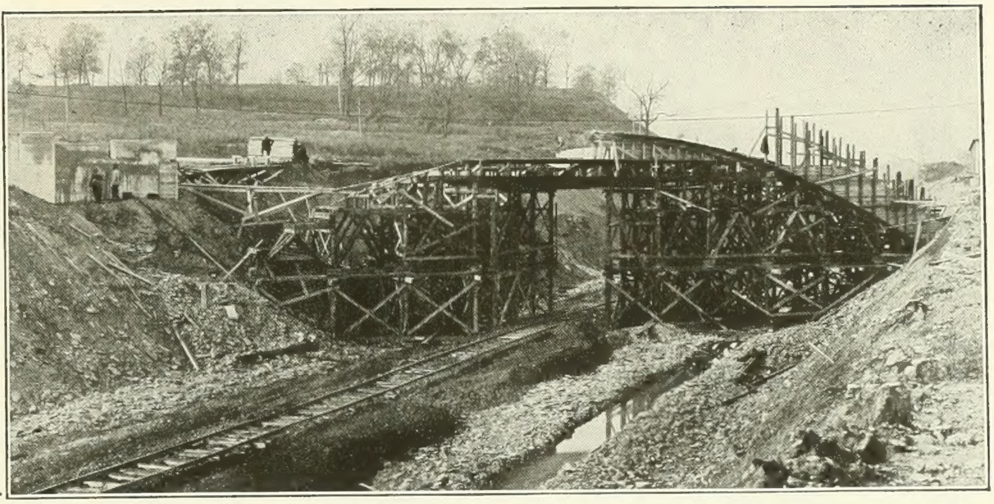

FIG. 178—FALSEWORK FOR HUFFMAN THREE-HINGED ARCH BRIDGE. OCT. 22, 1919.

each abutment, and at the top of the rise, and a ring and pin joint is introduced at each of the cuts. The arch as thus made consists of two entirely separate pieces, each piece being hinged at each end. When in hot weather such an arch expands, the crown is free to rise, each half swinging slightly upward on its abutment hinge, while the crown hinge by turning slightly prevents the formation of the bending stresses above referred to.

Besides this advantage, the three-hinged arch is somewhat easier of design owing to the simpler calculation of the stresses in the parts. On the other hand, the introduction of three hinges somewhat detracts from the rigidity of the structure laterally, and makes it important to provide lateral stiffness in other ways. On the whole, the advantages of the hinge design were believed by the Conservancy engineers to be sufficient to merit its adoption.

It should be added that, practically, the three hinged arch design provides two arch ribs side by side, instead of one arch, these two ribs being cross-braced to each other, and the bridge floor supported between them.

The Huffman bridge is the second of this design to be built by the District. The first, which is at Taylorsville, spanning the Baltimore and Ohio relocation, is not a skew bridge. It was described in the Bulletin for October, 1919, and illustrated at Fig. 28 of that article. See also Fig. 181 in this issue.

The span of the Huffman arch between end hinges is 126 feet, and the rise to the crown is 21 feet, the ratio of rise to span being therefore one to six. The arch ribs have steel reinforcement (round bars), but no structural steel shapes (channels, angles, etc.), were employed except for connections. The hinges are of cast steel, and the pins of bronze, 2¼ inches in diameter by 28 inches in length, the entire thrust of the arch being carried by each pair of pins.

The roadway is carried by the arches at an elevation a few feet below the crown hinge, being hung from the ribs near the crown and supported on columns the remainder of the span. The bridge is therefore of the type usually designated as a "semi-through arch." The roadway is 18 feet wide and is of the beam and slab type, three beams, one on each side and one along the center line, running the entire length of the structure, with cross beams every 11 feet. This arrangement divides the floor space into squares of about ten feet, occupied by concrete slabs 9 inches thick. The beams are 45 inches deep. A liberal provision for expansion was made in the floor, complete transverse joints being introduced at an interval of 18 ft. in case of the central division, and of 33 feet in the others. The same joints were carried through the parapets, which are anchored firmly to the floor.

It is one of the disadvantages of this type of arch that the concrete forms are more complicated than for a barrel arch, requiring thus greater labor in the construction. At Huffman also an additional difficulty was introduced, due to the fact that a single track railroad had to be operated in the cut while the work was in progress, thus requiring an opening to be left in the timber falsework sustaining the forms. This opening was spanned by heavy I-beams as shown in Fig. 178. The ½ cubic yard Smith concrete mixer was at one end of the bridge, and the concrete was transported to the forms by a bucket hung from a traveller carriage running on a slackline cable way erected over the falsework. This cable way had a span of about 250 feet. One end was anchored beyond the end of the structure. The other was carried over a 45-foot mast and down to one drum of a two-drum steam hoist engine. The carriage was operated by a single line run back up to the mast and down to the other drum of the engine. It could be pulled back to the mast by the engine. In the other direction its own weight carried it. It could be lowered at any point by slacking away on the main cable. This rig picked up the framed false work bents and set them in place; also the longitudinal stringers and the steel I-beams spanning the opening for the railway track. It also handled the reinforcing steel and the steel hinge castings, as well as the concrete for the forms, the latter being carried in a one-yard bottom-dump bucket.

The work suffered materially from delays in delivery of the materials, due to labor troubles of one kind or other at the mills, and consequently the greater part of the concrete had to be placed in December, 1919, and January, 1920. This made it necessary to take precautions against freezing. An extra upright boiler was used to heat the water for

(*Continued on page 16.*)

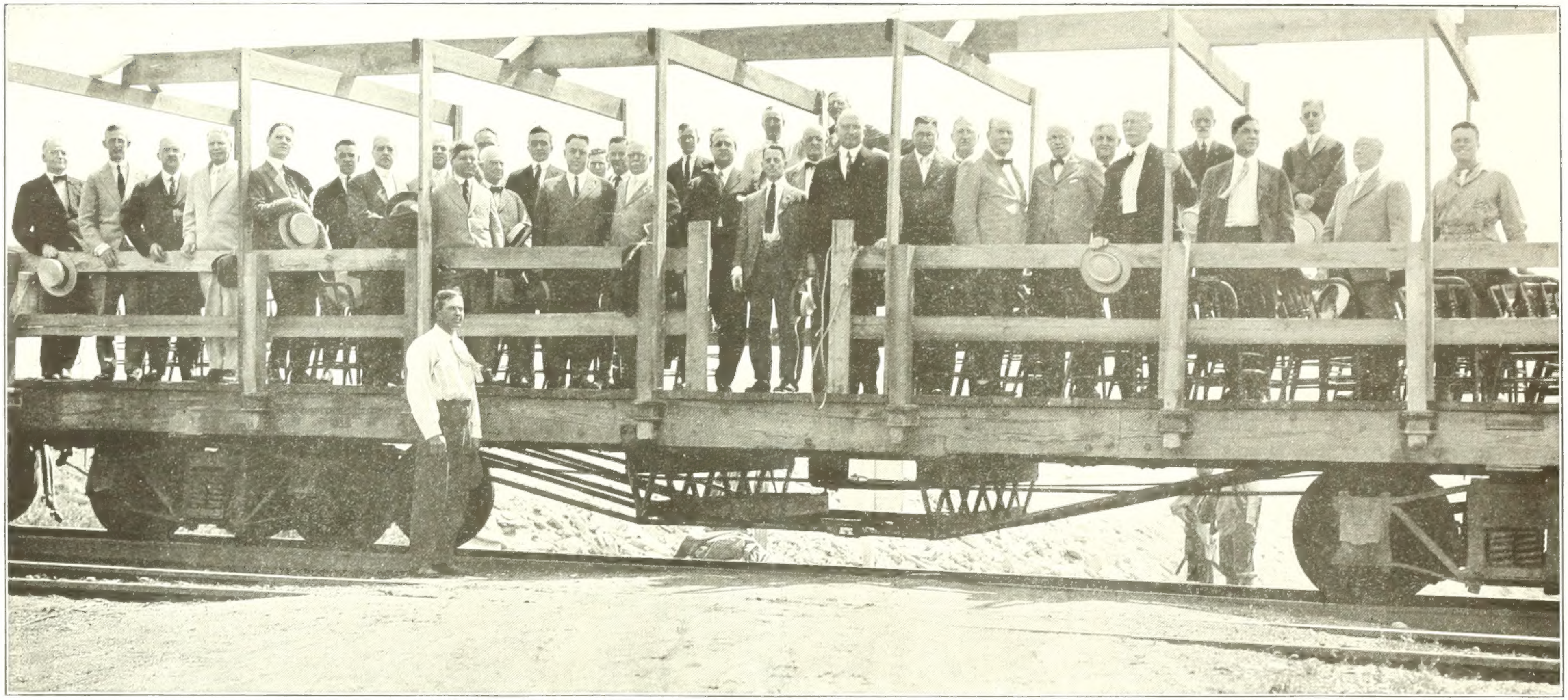

FIG. 179—THE DAYTON CITIZENS' RELIEF COMMISSION AT TAYLORSVILLE ON THE INSPECTION TRIP.

Reference was made in the last Bulletin to the tour of inspection of the Dayton Citizens' Relief Commission on July 7, as guests of the officers of the District, during which they visited the Conservancy work at the Germantown, Englewood, Taylorsville and Huffman dams, and the nearly finished work of the railway relocations. The above picture was taken at Taylorsville during this tour, and is published as an interesting memento of the occasion. The people on the car, from left to right, are as follows: John A. McGee, Fred H. Rike, A. M. Kittredge, John P. Breen, F. J. McCormick, ——————, Dr. C. W. King, ——————, E. E. Burkhart, T. P. Gaddis, Chief Engineer A. E. Morgan, T. A. Ferneding, Assistant Chief Engineer Chas. H. Paul, Ezra M. Kuhns, Division Engineer O. N. Floyd, Henry M. Allen, Assistant Engineer W. D. Kramer, Adam Schantz, Stanley M. Krohn (in front), B. & O. Trainmaster T. J. Daly, Construction Manager C. H. Locher, Col. E. A. Deeds, Judge Oren Britt Brown, Division Engineer Albert Larsen, Torrence Huffman, Mr. Blood, E. B. Weston, F. J. Ach, Edward Philipps, Edward Canby, J. Edward Sauer, J. F. Dodds, Fred Cappel, Assistant Division Engineer H. L. Freund. Standing beside the car, Superintendent H. M. Sherwood.

Many of the above men were members of the general committee appointed to assist the Citizens' Relief Committee, at the meeting called by John H. Patterson on April 20, 1913, to take up the matter of permanent flood prevention. It was this enlarged Flood Prevention Committee which raised the $2,000,000 flood prevention fund, the administration of which was then entrusted to the Dayton Citizens' Relief Commission, the latter including most of the men who had been acting on the Flood Prevention Committee. On the creation of the Miami Conservancy District, the Commission turned over to the District practically all of its activities, except the return of the $2,000,000 fund. The expense of the flood prevention work being provided for by the Conservancy law in other ways, the larger part of the fund is being returned to the subscribers. The greater part of the money was refunded in the spring of 1918, but a small remnant remains.

The tour of inspection was the carrying out of a plan, which the officers of the District have long had in mind, to invite the members of the Commission, whose work they took over, to see the progress which had been made on the project, after it had been advanced to a proper stage. The opening of the relocated Baltimore & Ohio R. R. on July 7 seemed to be an auspicious occasion for carrying out the plan, and the date for the event was selected accordingly.

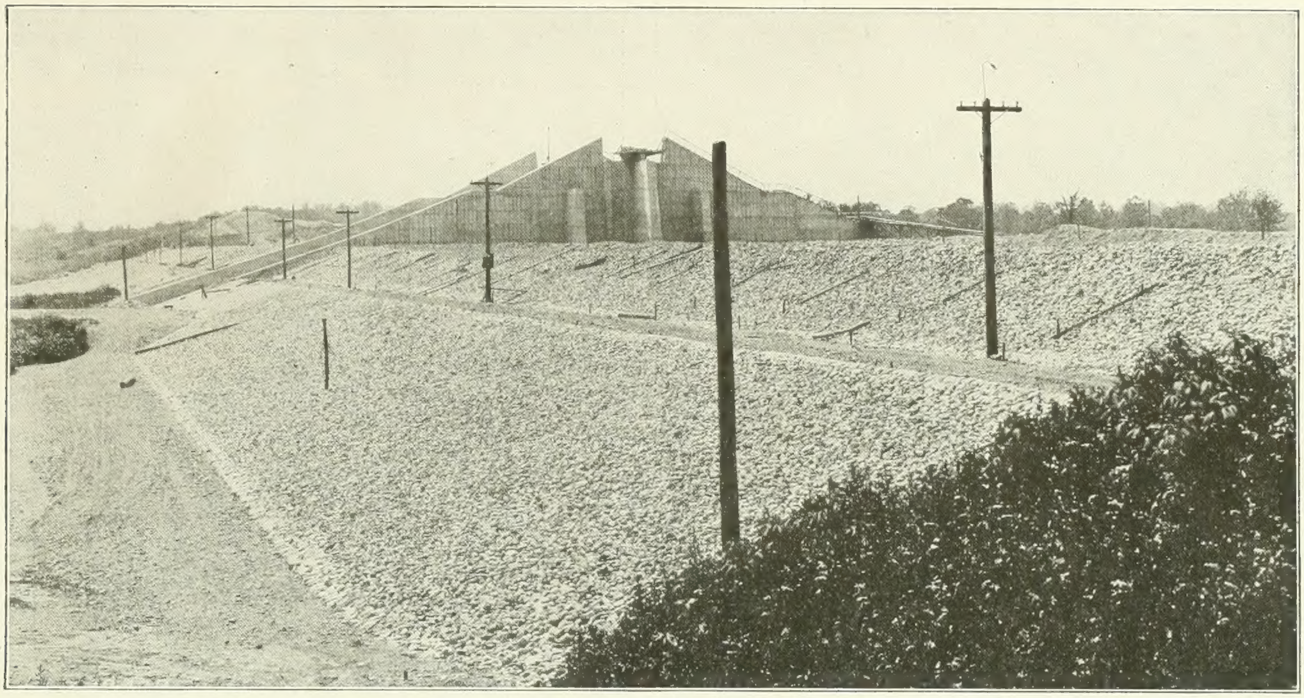

FIG. 180—LOOKING NORTHWEST AT THE LOCKINGTON DAM, JULY 20, 1920.

Special interest attaches to this picture, due to the fact that the elevation of the dam embankment, along the full length of both levees, is now up to a level above that which would be reached by a flood equal to that of 1913, in the present open condition of the outlet structure. This means that the danger of overtopping the dam during construction, to its possible injury, is now practically past. It also means that the valley below is given some measure of protection. Full protection will come when the concrete cross dam is built between the outlet structure walls, which work is expected to begin next spring. The earth fill will be up to full height before winter.

The slopes of the dam embankment are being surfaced with the larger rock from the borrow pit and the beaches of the hydraulic fill. It is not expected to grass the embankment as was planned at an earlier stage. Thus the slopes seen present nearly their finished appearance. The dam appears deserted, but in reality hydraulic fill is in active progress both east and west of the outlet structure walls. The east core pool is just beyond the top of the foreground slope. The pipe line going to the west core pool can be seen climbing the trestle just to the right of the outlet walls.

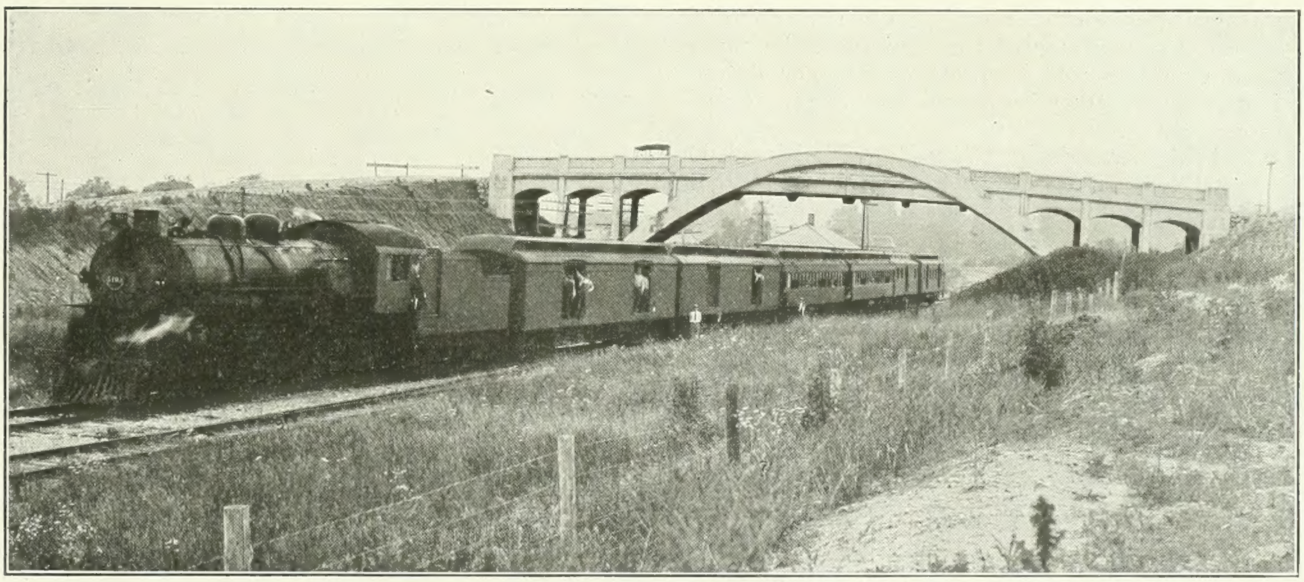

FIG. 181—THE FIRST PASSENGER TRAIN ON THE NEW B. & O. R. R. RELOCATION. JULY 7, 1920.

This is the regular passenger leaving Dayton at 7:25 a. m. It was preceded by a freight train, a few minutes earlier, the latter being the first train other than a work train to travel over the new line. The overhead bridge will carry traffic on the highway which is to be built on the crest of the Taylorsville dam, crossing the valley. The embankments to right and left of the train are levees, enclosing the new railway line for about eleven hundred feet north of the bridge, the track level being 18 feet below the dam crest. The latter required to be notched to that depth to accommodate the railway gradient between the dam and Dayton, which could not exceed 0.2 per cent. Hence the levees, which are virtual extensions of the dam embankment enclosing the railway and running north to higher ground. In case of extreme flood the opening between the north ends of the levees, permitting the exit of the tracks, will be closed temporarily with sand bags.

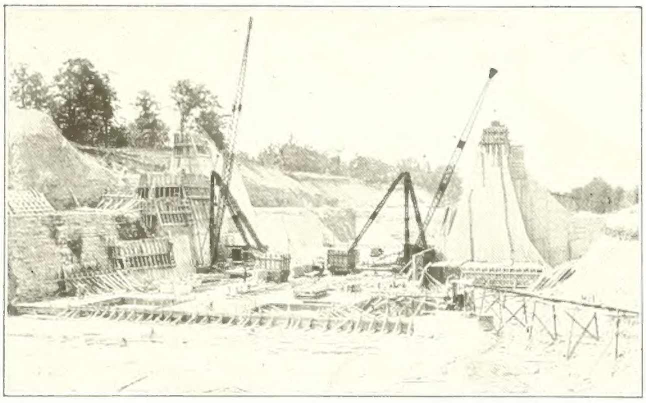

FIG. 182—OUTLET STRUCTURE AT TAYLORSVILLE, JULY 7, 1920.

This is shown here to indicate the relation of the west wall, Fig. 183, to the entire structure. The view is downstream. The floor is nearly completed, the edge of the level rock floor in the foreground marking its upstream limit. The locking of the left (east) wall into the rock ledge of the excavation shows clearly. The opening between the walls at the bottom is 93 feet, 4 inches. The concrete cross dam to be built between the walls will be pierced at the base by four rectangular conduits, with arched tops, each 15 feet wide by 19 feet, 2 inches high. These conduits will take the entire flow of the Miami River, (which is just out of the picture to the right,) except during extreme floods, when the excess will run through a concrete spillway channel carried between the walls on top of the cross dam. The total width of the concrete outlet structure, including both walls and the cut-off walls projecting into the earth embankment, is about 215 feet.

Three-Hinged Arch Road Bridge at Huffman

(*Continued from page 13.*)

the concrete. The sand and gravel were heated by being piled on old 15″ dredge pipes, in which fires were kept burning. The top of the structure was kept covered with canvas, under which salamanders were placed until the concrete had set beyond all danger of damage by freezing. On account of the rather open character of the structure, the protection during the cold weather was rather difficult, but it has apparently been sufficient to secure satisfactory results.

The bridge was designed by Ross M. Riegel, Designing Engineer for the District, and was built under the direction in the field of Leslie Wiley, Superintendent of Construction.

Concreting Records Again Broken at Taylorsville

The concreting record on the Conservancy work, established at Taylorsville on June 18, as announced in the last Bulletin, was again broken at the same dam on Monday, July 19, when in one ten hour shift 568 cubic yards of concrete were poured. The June 18 record was 522 cubic yards. The record for a week, made at Taylorsville the preceding month, was also broken, during the week ending on July 24, when a total of 2408 cubic yards were placed in the Taylorsville outlet. This is at the rate of 401 cubic yards per day, and includes the high day noted above, 568 cubic yards. This daily rate beats the largest single day at any other dam, which was 374 cubic yards. The new single shift record of 568 yards was poured in 437 batches of about 1.3 cubic yards per batch. The concrete is mixed in a 1-yard (so rated) Smith concrete mixer, transported to the forms in buckets on small cars, and hoisted into place by two stiff-leg derricks.

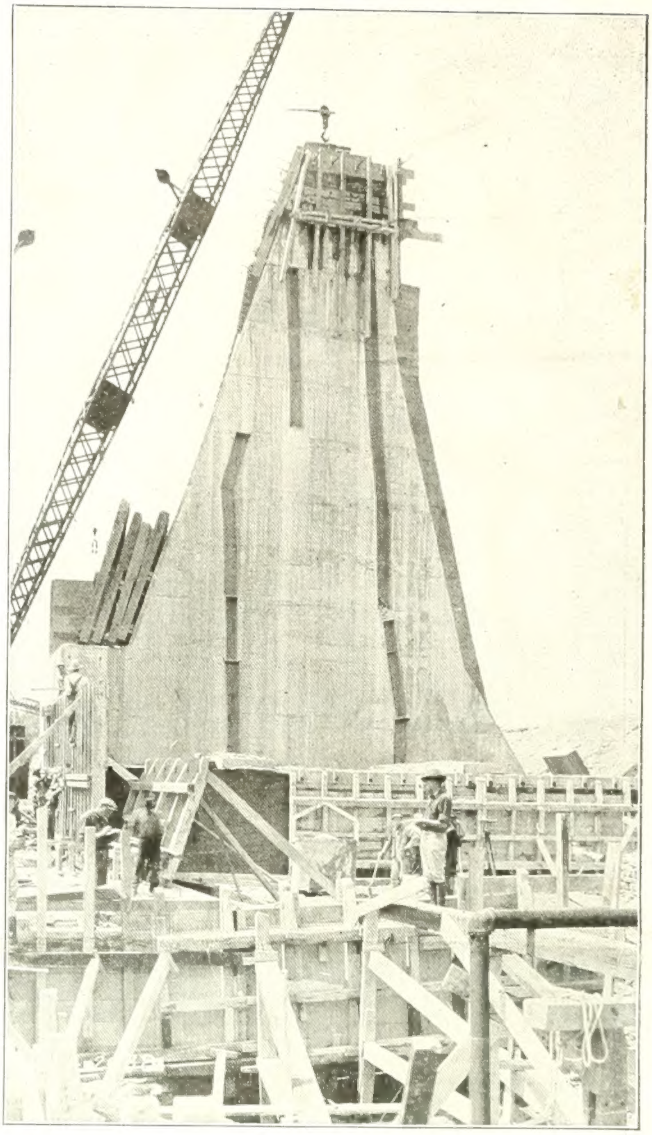

FIG. 183—WEST WALL OF TAYLORSVILLE CONDUIT OUTLET, JULY 20, 1920.

This is the right hand wall of Fig. 182, which shows the entire outlet. This wall at the base, (not including the cut-off wall, seen projecting at the right,) is 4 inches short of 50 feet in thickness. As seen, the wall is about 70 feet in height from the conduit floor, which is 7 feet thick, making a total height of the structure at the present stage of 77 feet. The finished top will be ten feet higher. The thickness at top will be 3 feet. The massive thickness at the base is to resist the heavy pressure of the earth fill of the dam, which will rest against the right hand face of the wall from bottom to top. The pressure of the saturated hydraulic fill core during construction is very great, and acts on the wall to overturn it, as in any earth retaining wall. This is not the case with the east wall, (the left hand wall in Fig. 182,) which being built against bed rock ledge, does not receive this force tending to overthrow it, and is made only 10 feet thick in consequence. After the earth fill is completed, the space between the two retaining walls will be filled with a concrete cross dam pierced by four conduits. If this cross dam could be built before the earth fill, it would take most of the thrust of the fill, and the right (west) wall could be much reduced in thickness. To give a wide waterway in case of heavy flood during construction, however, and thus save backing up the water behind the dam during the work, possibly overflowing and seriously injuring the unfinished structure, the building of the cross dam is postponed until the earth fill should be completed. The batter of the inside wall face is 1 in 3; of the top 30 feet of the outside face, 1 in 20; of the next 30 feet, 1 in 4; of the remainder, 1 in 1½. The shelf at the left side of the wall, about 18 feet above the floor, marks the top of the side wall of the west conduit.